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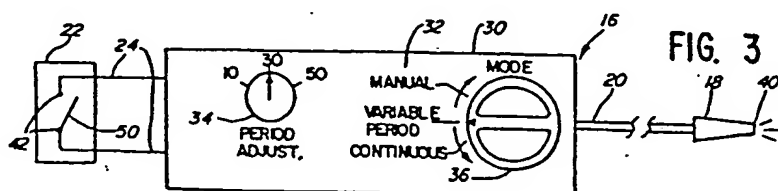
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## ⑤④ Method and apparatus for photoepilation.

⑤⑦ The certain quantity of light energy sufficient to effect lifelessness in each of a particular type of hairs is provided to the tip of a hand held probe (18) each time a switch (22) is closed, independent of the duration of the switch closure. A foot switch (22) is actuated to provide a series of timed and spaced pulses of light energy for a period selectable by rotating a wiper of a variable resistor-capacitor circuit. The sum of

the energies of the pulses over the selected period equals the certain quantity of light energy. Alternatively, four foot switches can be provided, one of which can be depressed to provide one of four fixed periods of light pulses. Commonly, the certain quantity of light energy is first determined for the hair type and then that certain quantity is used for all the hairs of that type to be removed.



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This invention relates to epilation primarily for cosmetic and medical purposes, and specifically relates to an improved method of performing photoepilation and an apparatus for performing the method.

Photoepilation is the removal of hair using light energy and is a known, commercially available process. It is performed to obtain cosmetically more pleasing skin by removal of unsightly hair from locations such as the face, legs, arms and back.

It is performed by an electrologist or operator seated opposite a patient and specifically opposite an exposed area of the patients skin on which the epilation is to be performed. The operator uses a magnification means such as wearing extended loupe eye glasses to sight on the hair follicles, and in one hand holds a light probe while in the other hand holds a tweezers, for removal of the hairs from the follicles after application of the light probe. The light probe is the termination of a flexible optical means, such as a bundle of optical fibers, that carry light energy to the hair follicle from a discharge lamp contained in a housing of a photoepilation device. The device includes the probe, the housing and a foot switch, which the operator depresses to control the number of light pulses to be provided by the device.

Performing the photoepilation is demanding of the operator's mental and physical faculties. The operator focuses his or her eyes on one hair and its follicle by looking through the extended loupe eye glasses, moves his or her head to the proper distance from the hair to obtain a sufficient magnification and/or clear focus and then holds his or her head still to maintain the desired sight of the follicle.

The operator then moves the tip of the probe, which sources the light energy, to the hair follicle and positions it for applying properly the light energy to the hair follicle. The operator then depresses his or her foot on the foot pedal to close the switch therein and energize the photoepilation device, providing the light energy in timed and spaced pulses. The number of pulses, or the time (which is proportional to the number of pulses) is counted by the operator either out loud or privately to apply the proper quantity of light energy to the hair follicle to effect lifelessness therein. When the proper quantity of energy has been applied to the hair to kill the hair body or root, the operator lifts his or her foot from the foot pedal to stop production of the light energy, and removes the hair from the follicle with the tweezers held in his or her other hand. The operator then moves to the next hair to be removed and repeats this entire demanding procedure.

The quantity of light energy produced by the device is regulated or dependant entirely and solely upon the length of time that the operator depresses the foot pedal of the switch assembly.

The electrologist, thus, to remove one hair, must have excellent motor skills to coordinate simultaneous movement of his or her head and eyes, both hands and one foot. Further, this procedure is tiring because of the physical and mental demands placed upon the electrologist to perform for extended periods.

It is desirable to alleviate at least one of the demands made of the electrologist.

Accordingly, the invention provides a method of photoepilation of a plurality of hair bodies of at least one type wherein light energy is conducted from a source to the hair root or the vicinity thereof by way of the tip of a probe by actuating a switch coupled to the source for the duration required to provide light energy sufficient to effect lifelessness of the hair body and repeating such process for affecting each of the plurality of hair bodies, characterized by the steps of selecting a certain period and applying the light energy by actuating the switch for a duration independent of said period selected.

Further, the invention provides an apparatus for performing photoepilation of a plurality of hair bodies of at least one type, including a source of light energy, a probe terminating at a tip and an optical cable coupled between the source and the tip for conducting light energy therebetween and a switch for energizing said source; characterized by a control circuit coupled between the source and the switch and capable of being energized by actuation of the switch to produce light energy for a certain period independent of the length of time the switch is actuated.

The preferred embodiments of this invention now will be described, by way of example, with reference to the drawings accompanying this specification in which:

Figure 1 depicts a scene in which an electrologist is performing a photoepilation procedure upon the hairs on the back of a patient;

Figure 2 is a block diagram of the one embodiment of the apparatus of the invention;

Figure 3 is a front side view of another embodiment of the apparatus of the invention; and

Figure 4 is a block diagram of the other embodiment of the apparatus of the invention.

10 In Figure 1, an electrologist or operator 10 is removing hair from the back 12 of a patient 14 using a proximately located photoepilation apparatus indicated generally by the reference character 16. Apparatus 16  
15 comprises a probe 18 held in the right hand of electrologist 10 and an optical cable 20 connecting the probe 18 to the apparatus 16. Optical cable 20 comprises flexible optical transmission means such as optical fibers. Apparatus 16 further includes a foot switch  
20 24. Assembly 16 is operatively located under the right foot of the electrologist. The electrologist 10 comfortably is seated opposite the bare back 12 of the seated patient 14. The electrologist 10 wears an extended loupe carrying eyeglasses 26 better to see the hair  
25 follicles on the patient's back 12 and holds a tweezers 28 in his or her left hand for removing lifeless hairs.

Typically all of the hairs or hair bodies to be removed from one region of a person's skin, such as face,  
30 arms, back, legs, are of one to three types, and the light energy that must be applied to each hair of one type to effect lifelessness therein is constant. Thus, once a particular quantity of light energy to effect lifelessness is established for a hair type, that  
35 quantity need only be repeatedly supplied to each hair root to perform the photoepilation.

In Figures 3 and 4, apparatus 16 includes a box-like housing or container 30 providing a face plate 32 on which are located a PERIOD ADJUST knob 34 and a MODE CONTROL knob 36. Interior of container 30, a pulsed light source 38, including a flash lamp, produces or sources light energy through the optical cable 20 to probe 18. The light energy is output from the tip 40 of the probe. The foot switch assembly 22, having one pair of normally open contacts 42 is connected to the apparatus by electrical cable 24. A control circuit 41, comprising mode selector circuit 44, timer circuit 46 and variable RC circuit 48, operate generally to produce timed and spaced pulses of light energy in source 38, and thereby to probe tip 40. Mode selector circuit 44 determines whether the flash lamp will be operated in one of three modes:

manually, for a period of time commencing and ending respectively with the closing and opening of contacts 42 by wiper or foot pedal 50; for a variable period commencing with the closing of contacts 42 by foot pedal 50 and extending for a duration determined by the setting of the variable RC circuit by knob 34 through shaft 52; and continuously for a period of time commencing with the closing of contacts 42 by foot pedal 50 and ending with a second closing of contacts 42 by foot pedal 50. In all cases, contacts 42 are closed by electrologist 10 depressing his or her foot on foot pedal 50 and are opened by the technologist raising his or her foot from the foot pedal. Rotation of knob 36 through shaft 54 effects selection of the desired mode.

In the manual and continuous modes, closing of contacts 42 is conducted to mode control circuit 44 by wires 56 from cable 24. In the variable period mode,

cable 24 directly carries the signal indicating closing of contacts 42 to variable RC circuit 48 and timer circuit 46. Timer 46 then produces a signal on wire 58 to selector 44 that has a period corresponding to that indicated by knob 34. In all three cases, mode selector circuit 44 includes a circuit to energize light source 38 and obtain regular timed and spaced pulses of light therefrom. The timing and spacing of the pulses is fixed to obtain equal but incremental quantities from each pulse of light energy. The only variable afforded by the control circuit 41 thus is the number of pulses or incremental quantities of light energy sourced to probe tip 40. The control circuit 41 does not count the number of pulses but provides them for a selected period.

In operation, the electrologist selects the variable period mode by rotating knob 36 and selects a certain period corresponding to the quantity of light energy, in the form of the timed and spaced pulses, required to be sourced at the tip 40 to effect lifelessness in a particular type of hair body. Selection occurs by rotation of knob 34 to vary the resistance or capacitance of circuit 48. The electrologist then adjusts his or her head to sight on one hair follicle, properly places the probe tip 40 in the vicinity of the follicle and depresses the foot pedal wiper 50 once. The control circuit then automatically, and independently of the length of time that the contacts 42 are closed, causes a series of timed and spaced pulses of light energy, for the selected period, to be sourced to the probe tip 40, and therefrom to the hair body to effect lifelessness therein. The electrologist then removes the lifeless hair body from the follicle, and moves to the next follicle, repeating the described procedure.

The method and apparatus of the invention thus relieve the electrologist from the manual counting of time or pulses to effect the lifelessness with the light energy. The termination of the selected period is seen by the electrologist by the lack of light pulses being supplied to the follicle from the probe tip. Operation in the manual and continuous mode is similar to that described in the previous paragraph but requiring a different actuation of the foot pedal 50 for each respective mode.

In Figure 2, a second embodiment of the photoepilation apparatus of the invention is indicated generally by reference character 60. The same reference characters indicate the same elements in Figures 2, 3 and 4.

Apparatus 60 comprises container 30, optical cable 20, probe 18, probe tip 40 and pulsed light source 38 previously described. A control circuit 62 includes a timer circuit 64, four resistor-capacitor networks RC1-RC4, respectively, 66-72, a switch assembly 74 and an electrical cable 76. Assembly 74 provides four, normally open pairs of contacts or switches 78-84. Switches 78-84 are mounted on a panel for operation by the electrologists's foot and may be such as push button switches. Four pairs of wires 86 connect the contacts of each switch to its respective resistor-capacitor circuit, these wire pairs forming cable 76. In turn, each resistor-capacitor circuit 66-72 is connected to timer circuit 64 by four separate wires 88. Timer circuit 64 is connected to light source 38 by wire 90.

Control circuit 62 provides four fixed and individually selectable periods of production of the light energy pulses from light source 38 corresponding to the four



switches 78-84. Switch 84 provides a period of fifteen (15) minutes, switch 82 provides a period of ten (10) seconds, switch 80 provides a period of thirty (30) seconds and switch 50 provides a period of fifty (50) seconds.

Actuating any one switch 78-84 energizes the corresponding resistor-capacitor circuit and causes timer circuit 64 to produce pulsing signals on wire 90 for the selected period. The pulsing signals on wire 90 cause the flash lamp in light source 38 to flash at regular timed and spaced intervals for the period, providing equal energy light energy pulses at probe tip 40.

The photoepilation procedure performance with apparatus 60 is similar to the procedure performance with apparatus 16, except there is no setting of a mode or period. Instead, selecting a certain period occurs by selecting the desired foot actuated push button switch, which then is depressed to source the required quantity of light energy at the probe tip. Sourcing the light energy pulses is independent of the length of time that the selected switch is actuated.

Selection of the period or energy necessary to effect lifelessness in a particular type of hair is by experiment or otherwise as desired.

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Known timing circuits, including monostable multivibrators, can provide the period signals in an apparatus 60. One circuit may provide each fixed period or one circuit may provide all four fixed periods. A known timing circuit, such as a monostable multivibrator can provide the single variable period circuit in apparatus 16. In either case, a circuit such as a monostable

multivibrator or one shot, provides a timing signal having a period independent of the switch closure or  
5 actuation time. This frees the electrologist from the requirement of having to regulate or control, by counting, the light energy applied to each hair body.

Different control and timing circuits, and switch  
10 arrangements and locations can be employed.

Thus, the invention involves providing a certain quantity of light energy at the tip of a probe sufficient to effect lifelessness in a hair body upon the closure of  
15 a pair of switch contacts, independent of the duration of the closure of said switch contacts. The quantity of light energy is provided in the form of incremental flashes or pulses of light energy, each of which having  
20 a light energy quantity equal to the others, but less than the proper quantity. The pulses are provided in like, timed and spaced relation to one another so that providing a series of the pulses for a selected duration period provides the proper quantity of light energy. In effect, the sum of the energies of the light pulses  
25 provided in the selected period equals the proper quantity of light energy to effect the lifelessness.

The demands upon the electrologist are alleviated by the electrologist selecting the period by setting the  
30 period duration to obtain the proper quantity of light energy to effect the lifelessness in a particular type of hair located on such as a face, an arm or a back. Then for each hair of the type, the electrologist need only actuate a switch once to obtain the proper quantity of light energy. The duration of the actuation of  
35 the switch need not be precisely regulated by the

electrologist because the duration of the selected  
period is independent of the duration of switch clo-  
5 sure.

The apparatus of the invention comprises a flasch  
lamp and control curcuit assembly, a hand held probe  
connected to the flash lamp by a bundle of flexible,  
10 optical fibers and a foot switch assembly electrically  
connected to the control circuit by a cable. The con-  
trol circuit is operable, in reaction to actuation of  
the foot switch, to flash the lamp in timed and spaced  
pulses of equal light energy.

15 In one embodiment, the foot switch assembly comprises  
a plurality of switches, one switch for each of a plu-  
rality of fixed periods. Selecting the certain period  
then comprises placing the operator's foot above the  
20 switch corresponding to the quantity of light energy  
required to effect the lifelessness in the type of  
hair to be removed from the subject patient. Alterna-  
tively, the control circuit includes a variable timer  
for selecting the certain period and the foot switch  
25 assembly comprises one switch for commencing the pe-  
riod. Selecting the period thus comprises moving the  
wiper of a variable resistor or capacitor to a parti-  
cular setting.

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## CLAIMS:

1. A method of photoepilation of a plurality of hair bodies of at least one type wherein light energy is  
5 conducted from a source to the hair root or the vicinity thereof by way of the tip of a probe by actuating a switch coupled to the source for the duration required to provide light energy sufficient to effect lifelessness of the hair body and repeating such process  
10 for affecting each of the plurality of hair bodies, characterized by the steps of selecting a certain period and applying the light energy by actuating the switch for a duration independent of said period selected.
- 15 2. The photoepilation method according to claim 1 characterized in that the step of selecting a certain period includes varying the components of a timer circuit.
- 20 3. The photoepilation method according to claim 1 characterized in that the step of selecting a certain period includes selecting one of a plurality of switches, each switch being associated with one of a  
25 plurality of certain periods.
4. An apparatus for performing photoepilation of a plurality of hair bodies of at least one type, including a source of light energy, a probe terminating at  
30 a tip and an optical cable coupled between the source and the tip for conducting light energy therebetween and a switch for energizing said source; characterized by a control circuit (41, 62) coupled between the source (38) and the switch (22, 74) and capable of being  
35 energized by actuation of the switch to produce light energy for a certain period independent of the length of time the switch is actuated.

5. The photoepilation apparatus according to claim 4, characterized in that said control circuit includes at least one timer circuit (46, 64) operating for said certain period to produce said light energy independent of the length of time the switch (22, 74) is actuated.

6. The photoepilation apparatus according to claim 5, characterized in that said timer circuit (46) includes variable components (48) for setting said certain period.

7. The photoepilation apparatus according to claim 5, characterized in that said timer circuit (64) includes a plurality of fixed components (66, 68, 70, 72) arranged to provide a plurality of certain periods and there are a plurality of switches (78, 80, 82, 84) one for each certain period, actuation of one switch energizing the control circuit (62) for one certain period.

8. The photoepilation apparatus according to any one of claims 4 to 7, characterized in that all switches are foot-actuated switches.

9. The photoepilation apparatus according to any one of claims 4 to 8, characterized in that the probe is portable and capable of being hand-held during operation of said apparatus.

FIG. 1

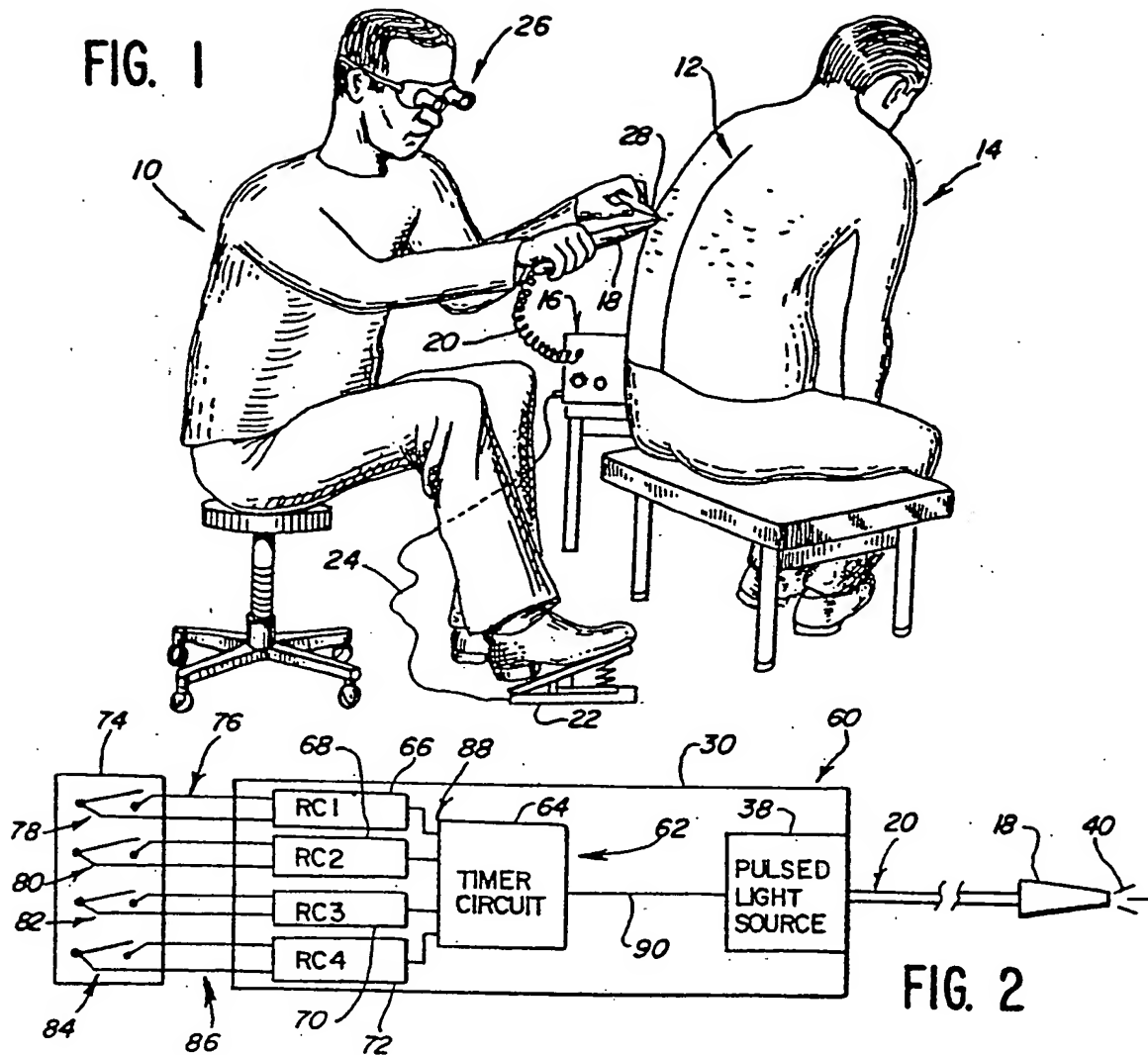


FIG. 2

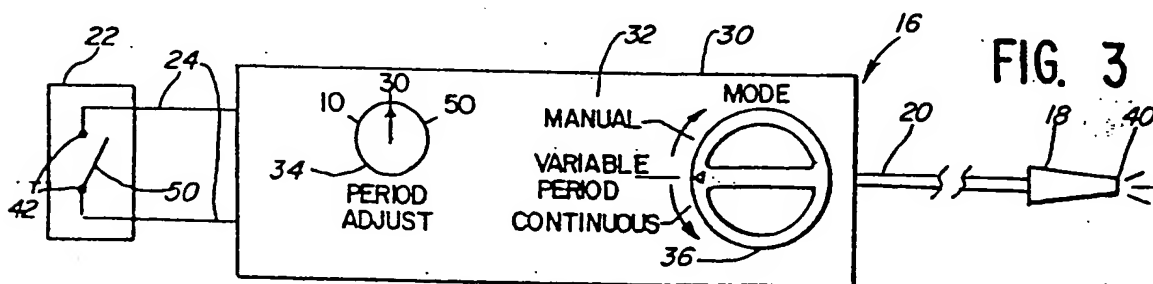


FIG. 3

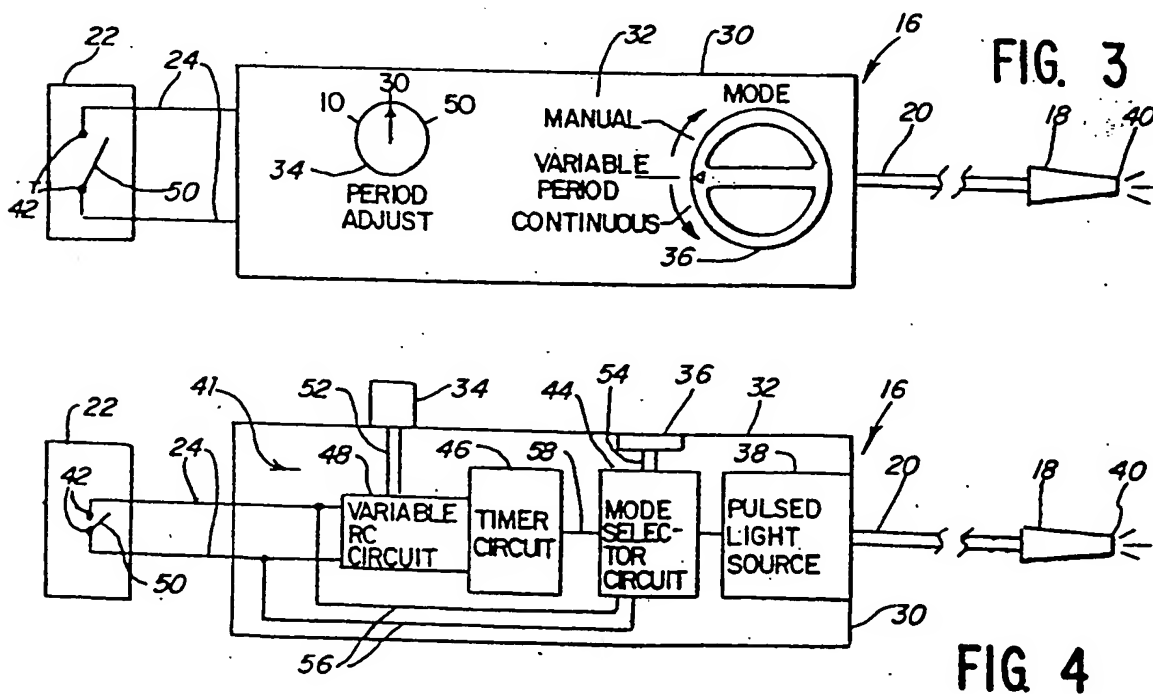
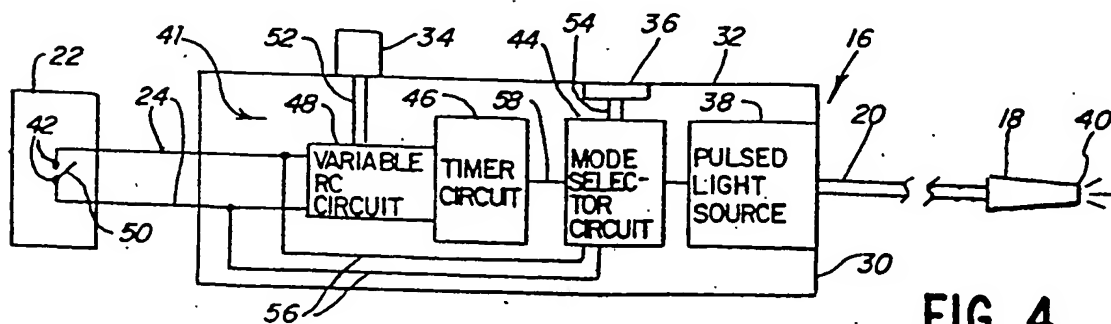


FIG. 4





EP 84 11 1249

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	US-A-4 388 924 (WEISSMAN et al.) * whole document *	1-9	A 61 B 17/36
Y	US-A-3 693 623 (HARTE et al.) * figures; column 3, lines 6-22; claims 1-7 *	1-9	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			A 61 B A 61 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-12-1984	Examiner LOWE D.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			